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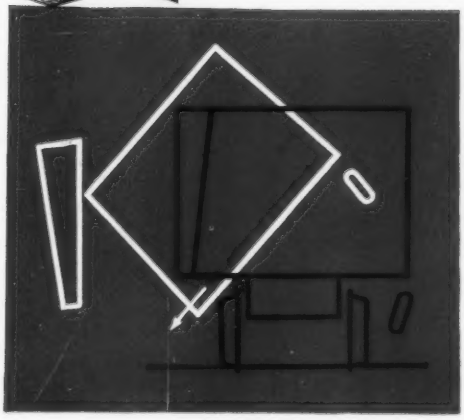

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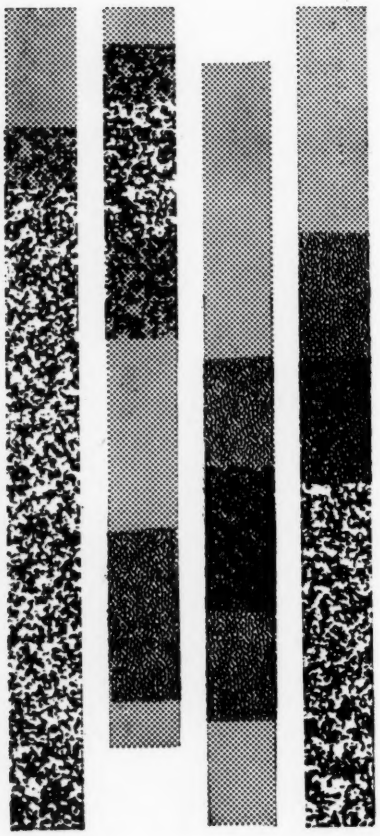

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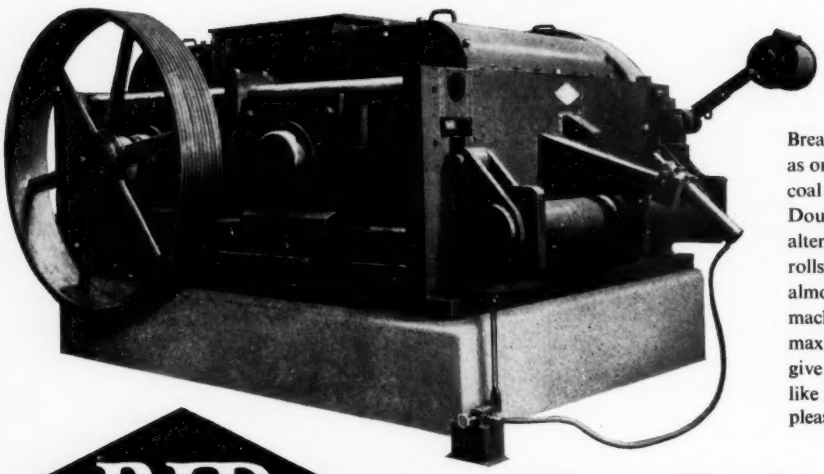

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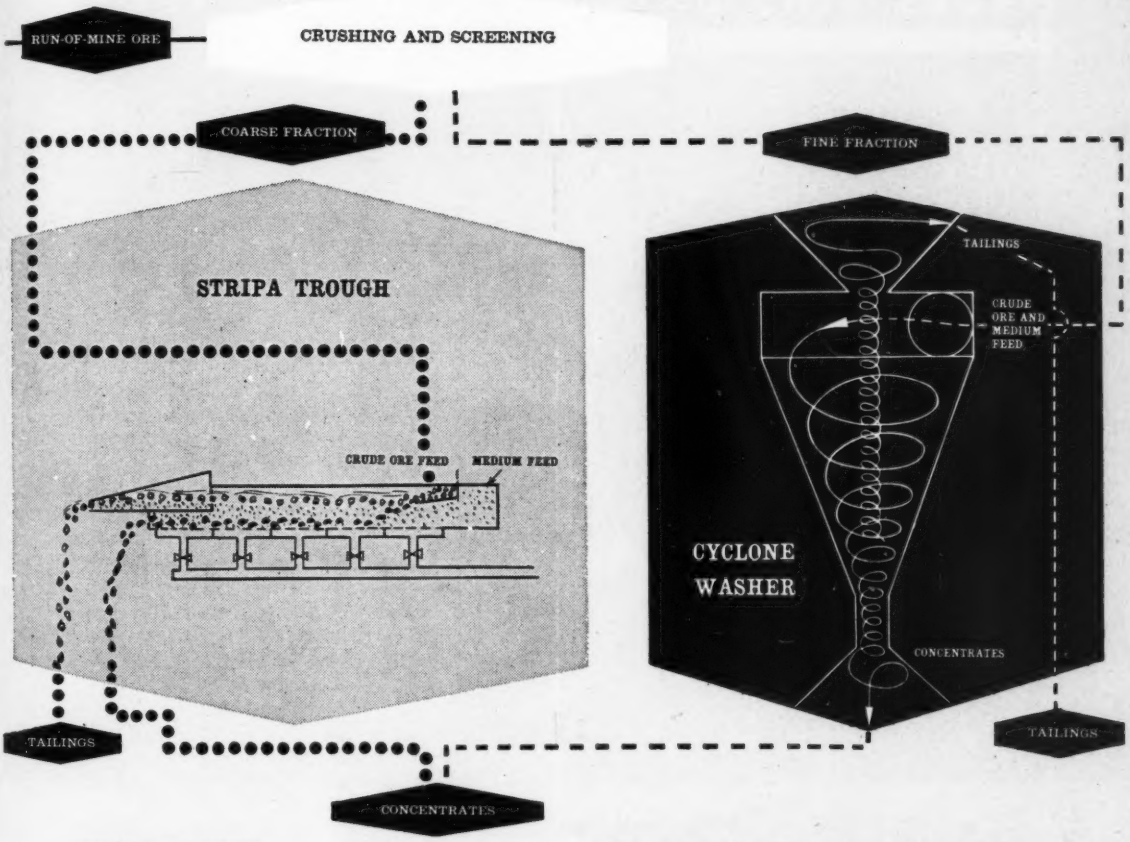

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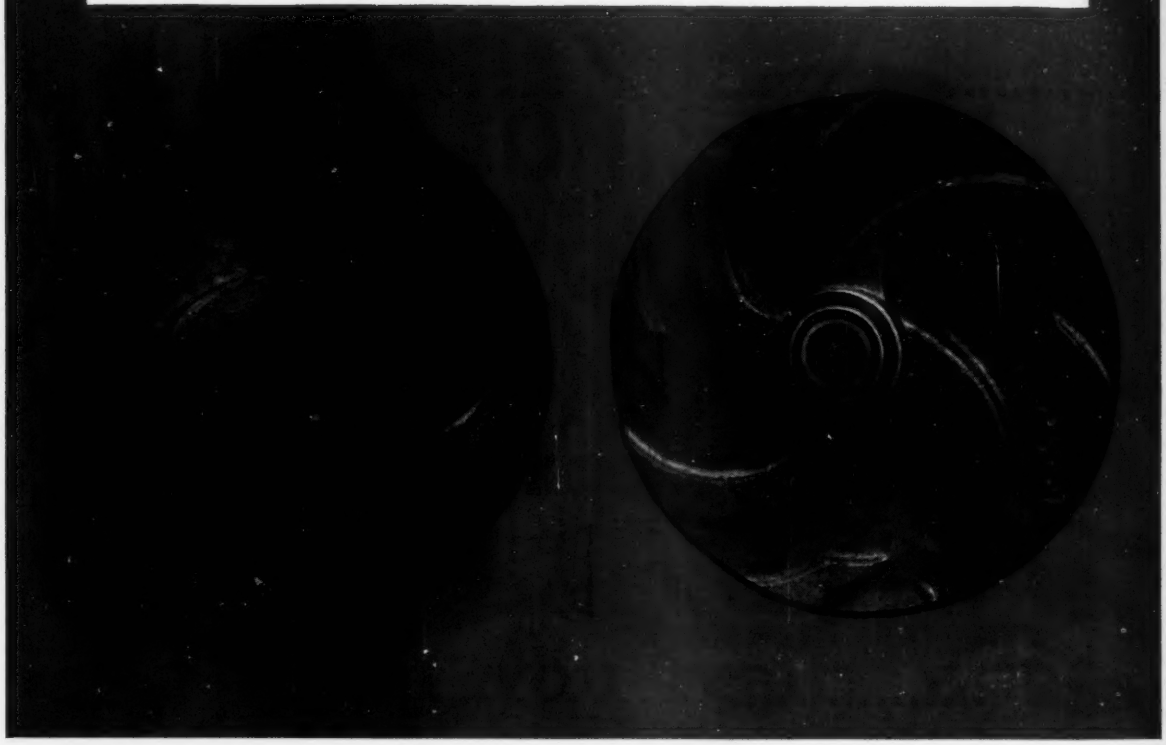

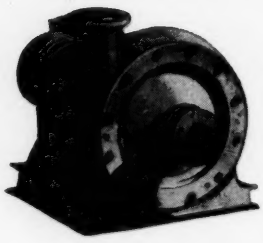

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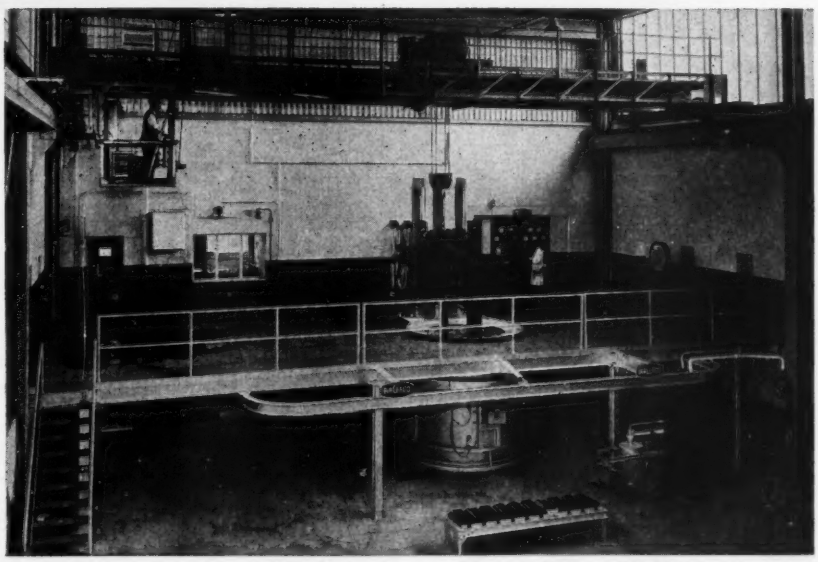

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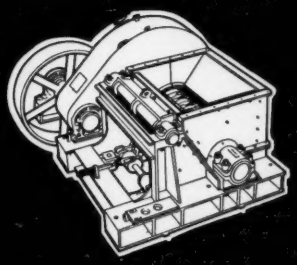

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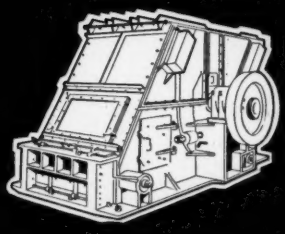

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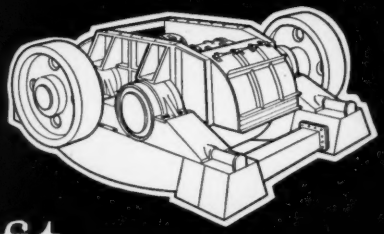

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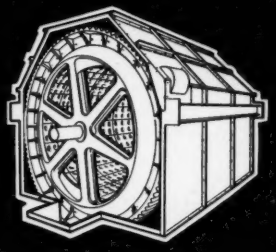

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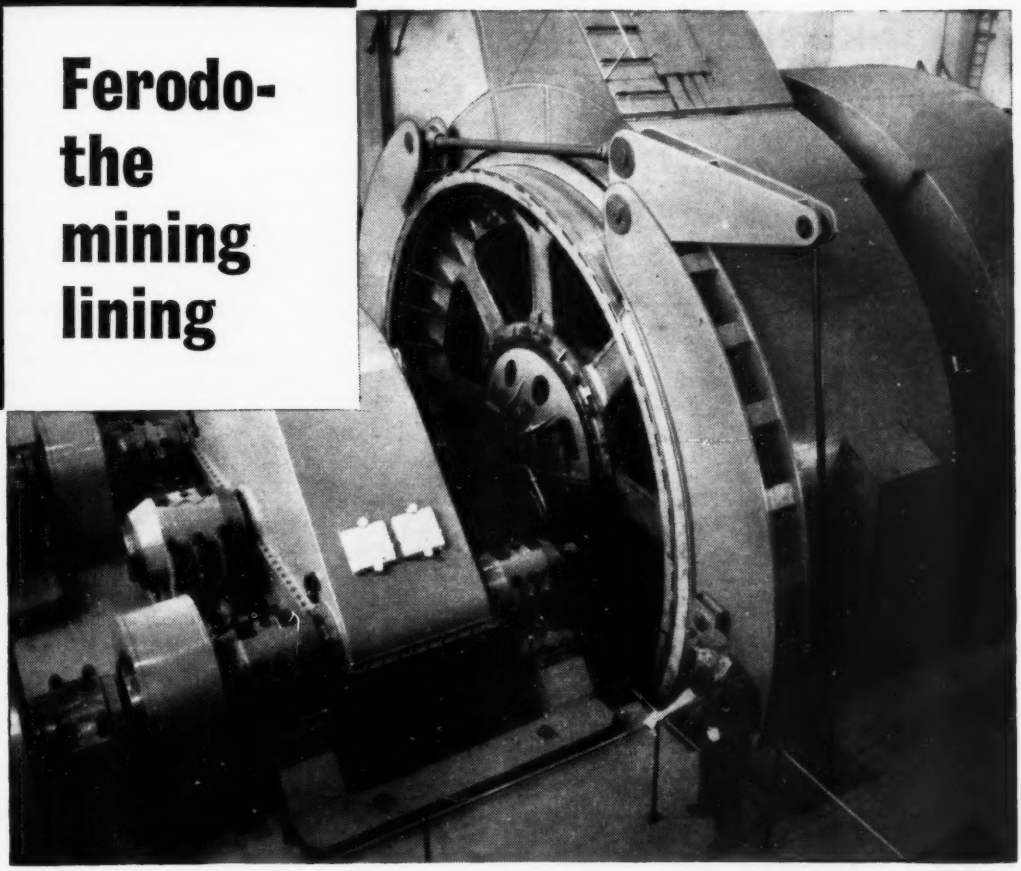

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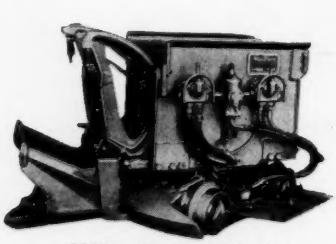
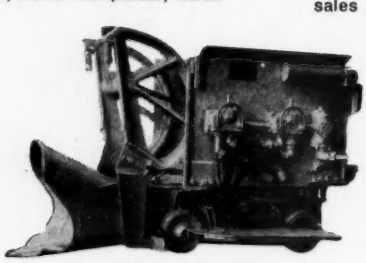
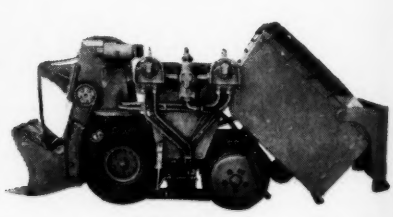


LM56 rail-mounted loader



LM250 rail-mounted loader



T2G Auto-loader

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The Mining Journal

London, September 9, 1960

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The Education and Training of Mine Surveyors

THE view that the Statutory Certificate has done more to depreciate the worth and importance of mining surveying as a profession than any other single factor, is put forward by Prof. E. L. S. Potts and Mr. Kenneth Wardell in a paper entitled "The Education and Training of Mining Surveyors", delivered to the Chartered Surveyors' Annual Conference at Bangor on September 3.

The authors point out that mine surveying exists as a separate profession in almost every European country except Great Britain. That it does not do so in the great mineral-producing countries of the Commonwealth is described as a measure of our failure to produce professional surveyors of wide education and outlook, whose worth and status are as universally recognized as those, for example, of the German "Markscheider".

The paper points out that in many European countries the title "mining surveyor" is applied exclusively to those who have undergone the most rigorous education and training; the sub-professional level is not dignified by the title of "mine surveyor" but by that of "survey-technician", "surveying-deputy" or "surveying overman." If, as in the last 15 years, many more people of minimum ability and ambition are encouraged in the United Kingdom to take up mine surveying and are persuaded, as many have been, that the Statutory Certificate is the hallmark of the professional surveyor, then, in the opinion of the authors, the profession will continue in its gradual loss of status and esteem.

The present lack of suitably qualified men is attributed largely to the exaggerated influence which coal mining has exerted in the United Kingdom on the education and training of mining surveyors. It is emphasized that the present content of the syllabus, the exemptions available, and the education and training facilities, are geared almost wholly to coal mining and in particular to the statutory qualification for colliery surveyors. This situation is regarded as stultifying for two main reasons. First of all, it narrows very considerably the field of study and in so doing tends to lay emphasis upon a detailed knowledge of facts and techniques rather than upon general principles and the demonstration and significance of what is taught. Secondly, it limits the field of work and endeavour not only to coal mining but, more unfortunately, to coal mining in this country.

Potts and Wardell believe that this policy, particularly as it affects the future, is misguided and that the syllabus should be revised to cover the whole field of metalliferous and non-metalliferous mine surveying. Most coal mining surveyors in the United Kingdom, it is stated, have little perception not only of the problems and difficulties in physical surveying but also of the representation of information on maps, plans and sections where the mineral deposits lie at relatively high inclinations and have to be worked with different systems and techniques of mining.

Some of the drawbacks resulting from the present kind of syllabus from the standpoint of the overseas mining industry, can be seen from the observations of R. A. L. Black, Professor of Mining at Witwatersrand University, in a paper presented in April this year to the South African Institute of Mining and Metallurgy.

"No one questions the competence of current mine surveying standards and practice in South Africa," said Prof. Black. "Holings between shafts are regularly effected with great accuracy, and many other difficult problems in surveying are solved daily as a matter of routine in dozens of survey departments on the mines. But there have been considerable developments in recent years which have rendered many of the standard accepted procedures of Witwatersrand mine survey practice out of date. For instance, photogrammetric methods for topographical surveying of mining estates, gyroscopic methods to replace shaft plumbing, the tellurometer and geodimeter for linear measurement, statistical techniques for the adjustment of observational error, and methods of office computation. All these and other developments indicate that in the task of surveying on the mines there is scope for more highly trained surveyors than are commonly employed."

This does not mean, continues Prof. Black, that every junior employed on routine stop measuring and on lines and grades in development work requires to be a fully qualified professional surveyor, but it does mean that there should be a sprinkling of such men in the industry, some in mine survey offices, but mainly in head offices. These men would be responsible for the introduction into South African practice of modern survey science and would be responsible for the maintenance of the best standards in the future.

It is men of this calibre, with mature minds capable of original and imaginative thinking, that the education and training of mining surveyors should ideally seek to supply. Potts and Wardell regard full-time academic training at Universities or Colleges of Advanced Technology as essential to the attainment of the requisite level of professionalism. In urging that the syllabus of the Royal Institution of Chartered Surveyors' examinations should be revised to cover the whole field of metalliferous and non-metalliferous mine surveying, they express themselves as firmly opposed to any policy of education and training which aims at confining the aspiring professional surveyor to a field of study limited to the narrow requirements of one type of mining or of one country. No less strong is their conviction that the Institution's educational policy and programme should be divorced from the Statutory Certificate. The whole emphasis of the practical test, they state, is on factual knowledge of existing techniques and safety provisions.

The revised syllabus suggested in the paper covers the fundamentals of surveying, science, engineering, geology, mining law, mining economics and mining technology, thus enabling professional surveyors to take up any aspect of work on which they are now or could usefully in the future be employed.

The view is expressed that both the resources and most of the staff capable of satisfying the requirements of a University training in mining surveying already exist at several Universities within their mining, geological and civil engineering departments. How far advantage can be taken of these existing facilities is regarded as a matter to be pursued by the Institute. It is stressed, however, that the professional status of surveyors in Germany and Holland is greatly enhanced by the fact that mine surveying is considered sufficient of a discipline in itself to merit chairs in mine surveying at the technical universities. Every effort, it is urged, should be made to establish mine surveying on an equal footing with other branches within the Institution and with other professions.

No attempt is made to set out a fully detailed syllabus of examinations, but as an indication of what the authors have in mind a suggested programme for a full-time course of study for a minimum of three years either at a University or an appropriate College is briefly given. This would be followed by two years of approved practical training, during which time each candidate would be expected to make a special study of some aspect of his work and present a thesis or dissertation before qualifying for corporate membership of the Institution.

Finally, it is suggested that the Institution should set up a special committee to provide full-time or part-time courses of study. This committee would be composed not only of practising mine surveyors but also of representatives from Universities and Colleges, who would not hesitate to call in specialists in particular fields to advise where necessary. In addition, there ought to be at least one member not connected directly with mine surveying but aware of the present and probable future needs of the mining industry at home and abroad.

A policy of education and training for mining surveyors based on these fundamental principles must inevitably lead to a division between sub-professional and professional surveyors. However, as the paper points out, such a situation has already existed for years in practice. The declining status of the profession of mining surveyors, which is as old as mining, indicates the desirability of considering very seriously whether the time has not come to abandon the present policy of trying to graft something professional on to a basic education and training which are largely sub-professional.

EXPORT PROSPECTS IN ARGENTINA AND CHILE

An exploratory mission from the Council of British Manufacturers of Petroleum Equipment recently visited the Argentine and Chile. Its terms of reference were: (1) To introduce the potential of the British petroleum equipment industry to the state-owned oil industries of these two countries and to the oil companies operating there; (2) To investigate thoroughly the opportunities available in the category of capital goods: and (3) to discuss the possibilities of credit facilities if these were required.

Though the mission was concerned specifically with petroleum equipment, much of its report *(Exploratory Mission to the Argentine and Chile*, March, 1960, obtainable from the Council of British Manufacturers of Petroleum Equipment, 2 Princes Row, Buckingham Palace Road, London, S.W.1; price 12s. 6d. net), is of general export interest and its recommendations are no less applicable to mining machinery and equipment. After pointing out that a company wishing to do business in the Argentine should be suitably represented in the area by someone able to speak Spanish, including the technical language, the report stresses the need for continuous support from the United Kingdom if worth-while business is to be obtained. The recommendation is also made that British Industry should be encouraged to take a greater interest in the education of young Argentinian engineers and technicians.

In both Argentina and Chile the key word is "Credit" and the main potential customers in these countries for petroleum equipment require credit terms which cannot, at present be met by the British Authorities under the existing Credit Insurance conditions. If Britain considers the political and commercial risks in these two countries are too great, then the only alternative is to wait until conditions improve, by which time the opportunities for trade may well be irretrievably lost, particularly if one bears in

mind the possibility that there will be a strong demand for heavy capital equipment in Latin America over the next ten years or so, but that it will subsequently become more and more difficult to export any manufactured goods to the area.

If, on the other hand, the view is taken that the long term economic and political stability of these countries, especially Argentina, is bound to improve, then immediate action is necessary, and the hope is expressed that a change of heart and policy on the part of the government will not be delayed.

LEAD-ZINC BILL VETOED

As generally expected, President Eisenhower has vetoed the Bill passed by Congress to subsidize small United States producers of lead and zinc. (See *The Mining Journal*, August 26, p. 237.) Announcing his rejection of the Bill, the President said that he had been concerned for some time over the problems of U.S. lead and zinc miners, but declared the measure would harm rather than help the lead-zinc industry.

The Bill authorized the Department of Interior to pay subsidies not exceeding output by any one company of either 2,000 tons of lead and 2,000 tons of zinc annually. The subsidies would have been the difference between the market price of lead and 17 c. per lb. and the market price of zinc and 14½ c. per lb.

The Bill specified that the total subsidies paid to all producers could not exceed $4,800,000 a year. During debates in the House of Representatives and in the Senate, opponents challenged the total subsidy cost alleging the subsidies would cost far more than that. President Eisenhower expressed that same belief when he said the appropriations authorized in the measure would be completely "inadequate". The result would be, he said, that "the Bill's intended beneficiaries could be misled into production for which they would not receive the promised subsidies".

Mr. Eisenhower said that the Bill would have the following "fatal effects":

It would "intensify the industry's problems of generating substantial additional production at the expense of other miners' jobs".

The subsidies would complicate, "even frustrate", government programmes now in effect aimed at achieving a world-wide balance of production and consumption.

If the subsidies were to go into effect they would "generate demands for equal treatment and similar subsidies from other producers of lead and zinc as producers of many other minerals".

The increased output would "depress lead and zinc prices and thus cause cutbacks and layoffs of mine workers in the unsubsidized mines".

Western States congressmen also sponsored legislation to double U.S. tariffs on imports of lead and zinc ores and products but these measures died when Congress adjourned at the end of August.

INDIA'S MINERAL OUTPUT RISES

The total value of minerals produced in India during the first quarter of this year is estimated at Rs. 373,000,000, compared with Rs. 341,000,000 in the corresponding period of 1959, according to the Indian Bureau of Mines. This does not include petroleum, minor minerals and minerals prescribed under the Atomic Energy Act of 1948. The improvement was mainly due to the increase in the output of coal, iron ore, chromite, gold, dolomite and limestone. Coal was the leading commodity and was valued at Rs. 262,000,000 which is about 70 per cent of the total value of mineral production. The value of metallic minerals produced during the period was Rs. 75,000,000 of which the ferrous group of minerals accounted for Rs. 47,000,000 and the non-ferrous group for Rs. 28,000,000. The output of iron ore reached the peak figure of 2,600,000 tons.

Metal production during the first quarter of 1960 was valued at Rs. 469,000,000 which is 41 per cent higher than that of the corresponding quarter of the previous year. The increase was accounted for largely by higher outputs of steel, pit iron, aluminium and copper.

Exports of minerals from India during the first quarter of 1960 were valued at Rs. 125,000,000 and constituted about 8 per cent of the country's total foreign exchange earnings during that period. Japan continued to be the principal market for Indian minerals accounting for more than one-third in terms of the value of the export.

The Government of Mysore has proposed to reduce to a minimum the area of reservation for State exploitation of minerals, particularly manganese and iron ores, thus leaving a wide margin for the private sector to operate.

This was disclosed by Mr. K. F. Patil, Minister in charge of mining in Mysore at a gathering of mine-owners at Bangalore. Addressing the fifth annual general meeting of the Mysore State Mine-Owners' Association, he said that the Government proposals in that behalf were almost ready and would be announced as soon as the Government of India's approval for them was received.

The Singareni collieries have commissioned a third screening plant near Ramavaram, reports our correspondent. The plant was designed and fabricated by the staff and engineers of the collieries. At the screening plants coal is transported on conveyor belts directly from the mine into rail wagons. The new plant which is an improvement in design over its two predecessors, was inaugurated by Mr. Damodara Reddi, Operative Director.

The General Manager of the collieries said that the Rs. 1,200,000 plant would minimize the cost of transport of coal from the mine to the railhead. The cost of the entire plant could be recovered within five years by saving Rs. 250,000 per annum, the expensive surface haulage having been dispensed with.

BAUXITE IN WESTERN AUSTRALIA

Western Aluminium N.L., a subsidiary of Western Mining Corporation Ltd., has been drilling on bauxite leases in the Darling Ranges, Western Australia, since October, 1958. To date, 1,931 holes have been drilled. The work indicates reserves of 37,000,000 tons containing 44 per cent aluminium oxide; of this tonnage, 13,000,000 tons has a grade of 47 per cent aluminium oxide. The ore has very satisfactory chemical and physical characteristics. All alumina is in the easily treated form, the reactive silica content is low, and the filtering and settling characteristics of the residues from the dissolution of the bauxite are good. The area drilled so far, is a minor part of the area known to contain bauxite. Drilling continues to give satisfactory results and is adding to the reserves developed. Samples have been submitted to three aluminium producers in Japan and tests show that the bauxite can be treated in their plants.

The Western Australian Government has authorized the export of up to 1,250,000 tons of bauxite during the next five years, and this enabled the company to conclude arrangements for three trial shipments to be made, each of 10,000 tons of bauxite, one to each Japanese producer, for plant scale tests.

Iron Ore from M

SHEER above the gravel desert of Northern Mauritania rises a great range of iron-grey hills, known as the Khédia d'Idjil. The wealth of Khédia, which may one day release these people from the bondage of the desert, lies in the iron ore deposits which have been discovered on its north-eastern face. The iron ore content of these deposits has been assessed at between 63 and 68 per cent, or equal to that of the famous Swedish deposits. Certainly, if these deposits are exploited, the vast but extremely poor territory of Mauritania will at last have a source of revenue with which to finance the development of its 800,000 strong population.

The exploration of these deposits was begun in 1952 by a French, British, Canadian consortium, known as MIFERMA, or Societé des Mines de Fer de Mauritanie, and in 1957 it was decided to ask the International Bank for Reconstruction and Development for a loan of £24,000,000 in order to help develop this £60,000,000 project.

The construction and operation of mine, railway and port have now been fully investigated by Miferma engineers with the help of the Societé Minière et Metallurgique de Penarroya, and agreements covering their mutual rights and obligations have been signed between the company and the Government of Mauritania. The project has now been approved by the World Bank and the loan agreement has been signed.

Subscribed capital will be £19,000,000 of which 20 per cent will be British, 15 per cent Italian, 3 per cent German and 62 per cent French; £27,000,000 will come from the World Bank, and £11,000,000 from loans by the French Government. All British, Italian and German holdings are in the hands of the steel industries of the countries concerned. The French steel industry holds 15 per cent of the capital and the French State 27 per cent.

The intention is to mine 6,000,000 tons of ore a year. This will be evacuated by a railway 400 miles long to a mineral port to be constructed near the present fishing port of Port Etienne.

The chief attraction of the Khédia deposits is the ease with which they can be mined. Apart from their high quality, for the first twenty years they will only necessitate open cast mining. This, together with the extent of the deposits, conservatively estimated at 125,000,000 tons, and probably nearer 250,000,000, makes the Khédia a most attractive source of iron for the world.

Investigation of the Deposits

So far, Miferma's investigations for iron deposits have been limited to the Khédia d'Idjil, a range of hills in the shape of a right-angled triangle 25 km. long from east to west and 10 km. long from north to south, at its eastern extremity, rising 1,500 ft. in precipitous escarpments from the desert plain near Fort Gouraud.

The Khédia d'Idjil belongs to an early series of Precambrian rocks mainly comprising gneiss, quartzite and micaschist. The centre of the Khédia range is made up of breccia, of which the origin is still in dispute. The north and east faces, and also parts of the south face, are made up of iron-bearing quartzites, mostly banded (BHQ). This formation dips respectively to the south and the west between 60 deg. and 90 deg. With an average thickness of approximately 300 m., it contains valuable deposits of almost pure haematite interspersed with banded haematite quartzite They are similar to those found in Labrador, India and Venezuela and are commonly known as Lake Superior type. Professor Capdecomme of Toulouse University has shown from extensive mineralogical studies of the area that the mineral basis of the Khédia is haematite in the form of martite with occasionally a low percentage of magnetite.

So far, only three areas of the Khédia have been thoroughly investigated : Tazadit, which lies almost at the north-eastern end of the range, covering an area of 171,000 sq. m.; F'Dérik, at the western end of the triangle, 65,000 sq. m.; and Rouessa, which is in the middle of the long northern edge, 172,000 sq. m. Chemical analysis of over 10,000 drilling and other samples from these three areas shows that in some parts the iron ore content of the deposits is as high as 70 per cent.

Two types of ore have been distinguished in this formation, a hard, compact and very homogeneous ore with a density *in situ* of 4.5, and a laminated ore consisting of thin strips of haematite, generally continuous, interspersed with thin beds of silica. The density of this ore *in situ* is 3.5.

Drilling for water near the site of the future mining town of Idjil. In the background rises the Khédia range

Mauritania

Mauritania is a chronically poor country. Her one great hope of wealth lies in the development of her huge iron deposits, from which 6,000,000 tons of ore a year could be mined. This survey is reproduced from an article by Michael Crowder in "Steel News" the quarterly publication of the British Iron and Steel Federation which has been abridged. The photographs are by courtesy of the Federation.

A view of Khédia from the Tazadit peak, which will be the first of the Fort Gouraud deposits to be exploited by MIFERMA. Below can be seen a small mining camp

Tazadit is mainly made up of laminated ore, in the form of a homogeneous mass at a dip of 50-60 deg. S-W. Its average thickness is about 150 m. Studies have been made over a length of 1,200 m., and to a depth from its crest at 720 m. above sea level down to the 350 m. level, but the actual depth of the ore body has not yet been assessed. F'Dérik, which consists entirely of compact ore, is made up of an off-vertical layer varying around 40 m. in thickness. In this layer there are several pockets of great importance, which are to be found mainly in the west. Some of these are more than 100 m. thick. Studies of the F'Dérik deposit have ranged over a length of 900 m., and to a depth between 550 m. and 250 m. above sea level. Rouessa, which contains both compact and laminated deposits in about equal proportion, has not yet been fully investigated. Several pockets of a thickness of about 30 to 40 m. and a depth of about 50 m. have been located.

Statistics for the proved tonnages of open cast ore are: Tazadit, 87,000,000; F'Dérik, 23,000,000 and Rouessa, 14,,500,000, totailing 124,500,000 tons.

There is little doubt that there are well over 250,000,000 tons of high quality ore in the Khédia range, even though it has not yet been thoroughly explored. It is known that outcrops exist all along the BHQ series, of which only 25 per cent has been thoroughly studied, and that the deposits already investigated still continue downwards. The BHQ has an average iron ore content of 40 per cent which is higher than some of the iron mined in Britain today. The tonnage of the BHQ series is estimated at 8,000,000,000.

How They will be Mined

The mining project has been prepared by Miferma in conjunction with the Societé Minière et Metallurgique de Penarroya, the railway with the help of "Sofrerails", a consulting organization sponsored by the Societé Nationale des Chemins de Fer Français (French State Railways), and the port with the help of the Chief Port Engineer of the French Navy and other government and private organizations. Negotiations with the World Bank have been completed this spring, work on the site will start at the end of summer, and the ore will come on to the market in the middle of 1963.

Development is planned in such a way that ore will flow immediately at a rate of 4,000,000 tons a year, and full output of 6,000,000 tons will be achieved within five years of the start of production. Work will start on the Tazadit deposit, particularly easy to work because of its huge extent and the favourable nature of its physical relief.

During the first years, work will proceed on faces opened up on the hillside above the 600 m. level, and will require very little removal of waste. Later on, the ore body will be followed down by a V-shaped cut at least as far as the 400 m. level. Stripping ratio will be 1.48 waste-ore.

The ore will be moved by truck and later by skip to a primary crusher and thence by conveyor through a tunnel 1,000 yds. long under the outer spur of the range down to the stocking area and railway loading point.

F'Dérik will be opened up a little later. The orebody is narrower and the overall proportion of waste to ore, down to the 360 m. level where it is at present planned to stop the open pit, will be 1.67. It is expected to take a further 20,000,000 tons from this deposit between the bottom of the open pit and plain level at 300 m. by easy underground methods.

No plans have been drawn up at present for putting the Rouessa deposit into production. Investigations on this deposit will be completed and extended to the other outcrops in the Khédia whilst Tazadit and F'Dérik are being equipped.

A Mining Town

Major problems in the exploitation of the Khédia iron deposits are the construction of the mining town and the evacuation of the ore. Because of the isolated position of the new mining town of Idjil, all its requirements will have to be brought in. Fortunately, the major problem of water has been solved, for drilling has revealed that there are good supplies of water underground, and vast reserves of water have been found near Port Etienne. Already a number of successful wells have been sunk. In July, 1958, a delegation of medical experts and town planners visited the site of the future town of Idjil to study the difficulties of building, in the middle of the desert, a town which will have an eventual population of nearly 4,000. The first buildings have already been put up in accordance with their recommendations. Diesel electric generators will be used to supply the town with light and the mine with power.

Difficulty of Direct Route

The biggest problem of all, and the one that has held back the exploitation of these valuable deposits from the start, is the distance of Fort Gouraud from the coast. A railway will have to be laid from Fort Gouraud to Port Etienne to evacuate the mineral. The best solution would have been a direct line to Villa Cisneros, the capital of Rio de Oro. Though Villa Cisneros is only 412 km. from the mine, it has been decided to use Port Etienne since it would involve considerable and costly dredging of the harbour to make Villa Cisneros suitable as a port for 25,000 ton mineral ships. Looking to the future, when mineral ships of 60,000 tons may eventually be used, the cost of dredging would be quite prohibitive. In Port Etienne no such dredging will be necessary.

Fortunately, the size and carrying capacity of modern diesel-electric trains make it economic to evacuate minerals of low value like iron ore over great distances. The most direct and least expensive route for the railway would be for it to cut across a corner of Spanish Rio de Oro. However, if permission cannot be obtained for a railway to be built across this territory, then the line will have to make a detour along the Mauretanian border, a route which will encounter a number of natural obstacles absent from the direct route.

Negotiations with the Spanish Government are under way, but all plans have been prepared to build the railway entirely in Mauritanian territory.

Two mineral trains of 130 wagons, each capable of carrying 10,000 tons of ore at a time, will make the journey to Port Etienne in 16 hours. At the port, initial loading capacity will be 3,000 tons of ore an hour, which will be increased to 6,000 tons an hour if necessary.

The exploitation of the Khédia reserves should be of immense benefit to a territory as chronically poor as Mauretania. Six million tons of ore, worth roughly £5 per ton, will make Mauretania one of the highest *per capita* exporters in West Africa, and the taxation agreement signed between the company and the Mauretanian Government provides that profits will be split on a 50-50 basis.

Electricity Supply in Southern Rhodesia

IN less than a quarter of a century, Southern Rhodesia has advanced from a position in which rural electrification hardly existed to one in which it is now probably the most highly developed in the African continent. This is a notable example of the economic benefits which follow from mining expansion, for it was largely to supply electrical energy to the mines that the Southern Rhodesia Electricity Supply Commission was established. The story of this undertaking is told in an illustrated brochure issued by the Commission.

In October, 1933, the Bernheim Mine in the Mazoe district of Southern Rhodesia applied to the Salisbury Municipality for a supply of electricity. The Municipality approached the government for financial assistance to provide the necessary capital for the line.

In the view of the Minister of Mines at the time, there was every reason for encouraging the proposed development. By supplying power from central electricity stations instead of relying on crude oil engines or wood-fired boilers at each mine, the country would save the cost of importing fuel oil. Instead of burning up its timber it would use its own coal deposits. A reliable source of power would be provided and the frequent and costly delays caused by breakdowns of prime movers at the mines would be eliminated.

However, to supply the Bernheim Mine on its own was uneconomic. To improve the economics of the proposal, the inclusion of the smaller mines in the vicinity was considered. A month later, the Gatooma Muncipality requested the government to consider a scheme whereby the municipal station would supply power to mines and farms in the Gatooma district. As a result, the first official report was prepared on the supply of electrical energy to mines in Southern Rhodesia. More detailed surveys of the load potential of the principal mining areas were subsequently undertaken.

The Electricity Supply Act was promulgated with effect from July 1, 1936, bringing the Electricity Supply Commission into being. Its creation was welcomed by the Rhodesian Mining Federation as "economically sound and the most practical way yet devised of assisting the mining industry".

The sales record of the Commission has been one of uninterrupted progress culminating in 1959 in sales of 680,000,000 units for £3,300,000. About four-fifths of the electricity sold by the Commission is generated in its own coal-fired stations.

In the early years by far the greater proportion of the Commission's output was sold to mines, particularly gold mines, but since then an increasing proportion has been sold to other consumers; notably to industry, municipalities and farms. In 1940, mines purchased nearly 90 per cent of the Commission's output. Today, although their consumption has risen by 500 per cent., they account for under a half of the Commission's output.

In common with all other businesses, the Commission has suffered from inflation. The total cost has increased from 0.82d. to 1.28d. per unit sold. In the same period the overall price of E.S.C. power has risen from 0.85d. to 1.17d. Both the average cost and the average power compare favourably with those ruling in most other countries. The Commission is faced with relatively high distribution costs because many of its consumers are scattered farms and mines. Its distribution system is over 7,000 miles long and has only one consumer for each mile of line. Generation costs, however, are so low that they counteract the higher distribution costs.

By supplying power generated from coal, the Commission has saved Southern Rhodesia about 30,000 acres of timber a year. This is of immense value, especially in arresting soil erosion. A market for the country's coal has been provided; a total of about 4,000,000 tons has been used in the Commission's stations since 1940. Money has been retained in the country instead of being used outside to import fuel oil for independent diesel plants. These are only a few of the many benefits which have flowed from a centralized power supply. With the advent of Kariba power this year, the Federation begins the transition from thermal to hydroelectric power.

Botanical Prospecting for Uranium on the Colorado Plateau

This article is abstracted from a report by Helen L. Cannon, prepared on behalf of the U.S. Atomic Energy Commission and published by the U.S. Government Printing Office, Washington D.C., as Geological Survey Bulletin 1085-A

A PROGRAMME of exploration and geological studies concerned with the uranium-vanadium deposits of the Colorado Plateau has been conducted since 1947 by the U.S. Geological Survey under the auspices of the Division of Raw Materials of the U.S. Atomic Energy Commission. Studies of the relations beween vegetation and these deposits began in 1947, and continued through 1956. The purpose of the investigation was to discover whether plants rooted in ore are different chemically or taxonomically from plants rooted in barren ground, and whether these differences can be used in prospecting for flat-lying ore deposits that are buried under a considerable thickness of shale and sandstone. Specifically, the investigation was set up to explore the possible significance of an association noted by Beath (1943) between selenium-indicator plants and uranium deposits of the Yellow Cat area in Utah; and also to determine whether the uranium and vanadium content of trees rooted in ore was significantly different from that of trees rooted in barren ground.

These studies have resulted in the development of two botanical methods of prospecting which utilize different field techniques. Prospecting by indicator plants requires that their distribution be mapped in regions believed to be favourable for the discovery of ore; by the plant-analysis method, samples of tree foliage are collected on a grid or linear pattern and analysed for uranium. The methods have been tested by collection and analysis of nearly 11,000 tree samples in 9 of the 10 districts of the Colorado Plateau and by studies of indicator plants along 50 miles of outcrop. Both methods have been evaluated by drilling programmes succeeding the plant studies.

The uranium-vanadium deposits of the Colorado Plateau occur in sedimentary beds ranging in age from Permian to Tertiary. Ore-bearing beds occur in the plant zones of ponderosa pine and Douglas fir and pinyon and juniper in the mountainous areas and higher mesas and in the plant zones of sagebrush and shadscale in the desert areas at lower altitudes. Indicator-plant associations found mainly in the shadscale zone and plant analysis in the conifer zones have been useful in prospecting.

Plants growing near ore deposits are affected by differences in the chemistry of the soil. The uranium deposits contain anomalously large amounts of vanadium, selenium, sulphur, molybdenum, cobalt, lead, zinc, nickel, copper and silver. Experimental studies show that the availability of selenium and sulphur for plant absorption is increased in the presence of carnotite and that, similarly, the availability of uranium and vanadium is increased by the presence of selenium and sulphur. These factors are important controls in the distribution of tolerant plants.

Those plant species that absorb and translocate large amounts of uranium to the upper parts of the plant are also found to contain large amounts of vanadium, and either selenium or sulphur. A reciprocal relation with potassium exists.

Uranium and vanadium are concentrated in the roots of plants. The decline in content is marked from the feeder roots, to the near-surface trunk roots, and the tree branches. The amount of uranium, however, found in the branch tips bears a definite relation to the amount of uranium available to the roots from the soil and rock in which the trees are rooted.

Physiological effects on herbaceous plants rooted in mineralized soil have been noted in the field and in plot experiments.

Plants found to be tolerant of mineralized ground and at the same time encouraged by the availability of some element in the ore are most useful in prospecting. The indicator-plant method is dependent upon changes in the local flora growing in mineralized ground. The plant societies are influenced in their distribution mainly by the presence of selenium and secondarily by gypsum, and increased availability of calcium and phosphorus in the ore deposits. The most effective indicator plant, *Astragalus pattersoni*, is able to concentrate enormous amounts of selenium from carnotite-ore deposits that contain very little selenium; this is due to the increased availability of selenium in the presence of carnotite. Prospecting by indicator plants is most effective in lower ecologic plant zones where the cover is open and herbaceous plant societies are free to develop, particularly where the ore contains more than 0.001 per cent selenium and is at an average depth of less than 40 ft. beneath the surface.

The tree-analysis method is dependent on the absorption and transport of anomalously large amounts of uranium by trees or shrubs rooted in ore at depth to plant parts that are easily sampled. In most areas prospected, amounts of 1 ppm uranium or more in tree foliage are indicative of mineralized ground. The cut-off value varies slightly with the species sampled and with the depth to ore. Maximum root lengths of 21 ft. have been measured for plant species in uranium districts of the Colorado Plateau. Root penetration to depths of from 50 to several hundred feet may be inferred from mine observations and from the chemical composition of surface vegetation. Tree analyses may be used effectively to outline mineralized ground to a maximum depth of about 70 ft.

Two methods of analysing plant ash for uranium content have been perfected in laboratories of the U.S. Geological Survey. The fluorimetric method is the most precise in low ranges, but is also expensive. The chromatographic test is an inexpensive field test designed for the prospector or small commercial laboratory but is least precise in the low ranges of plant content.

The U.S. Geological Survey has pioneered research on botanical methods of prospecting for uranium. The analysis of vegetation, however, has been used in the search for other types of mineral deposits in many countries. Tkalich (1938) used plants in prospecting for iron in Russia. A close association was shown to exist between the metal content of surface vegetation and ore bodies at depth by the Swedish Prospecting Co. (1939) in searching for vanadium-bearing shales in Sweden and in prospecting for tin and tungsten deposits in Cornwall, England. Botanical methods were also tried by Rankama (1940) in prospecting for nickel in Finland; by Hedström and Nordström (1945) in studying the chromite deposits of Greece; by Webb and Milman (1951), in prospecting for lead and zinc in Nigeria; and by Warren and Howatson (1947) in copper and zinc districts of Canada. In Rhodesia a flower known as *Ocimum Homblei de Wild* has been found to indicate the presence of copper ore.

Technical Briefs

Treatment Processes Investigated in the United States

Fused-salt electrorefining has been successfully applied to the purification of vanadium metal. The electrolyte used in this refining technique was sodium chloride to which had been added 3 to 6 per cent vanadium as vanadium dichloride. The average deposition current efficiency was 91 per cent. The application is described in U.S. Bureau of Mines *Report of Investigations* 5630.

Oxygen and nitrogen, the impurities in commercially produced vanadium metal, were reduced by two-thirds of the amount contained in the feed material. Hardness of the vanadium-metal product was reduced from an initial 97 Rockwell B (RB) to a minimum of 35 RB. The reduction of these impurities markedly improved the plasticity of the final product obtained by melting the crystalline cell metal into small ingots. These ingots could be given a 99 per cent cold reduction by rolling before edge cracking appeared.

Growing interest in high purity vanadium and the industrial need for purer metals and improved alloys for use under high temperatures and high speeds have demanded the elimination and/or control of impurities. Accordingly, research to eliminate or control the undesirable impurities has been expanded.

The technical feasibility of fused-salt electrorefining of titanium, beryllium, hafnium, and zirconium to remove impurities such as O_2 and N_2 has been developed and proved by the Bureau over the past several years. As a part of this programme of intensified research to produce purer metals, the fused-salt refining of vanadium was considered, because the gaseous impurities, nitrogen and oxygen, which can be controlled by this technique, have serious effects upon vanadium's physical properties. Commercially, the production of low nitrogen-oxygen vanadium by any standard reduction techniques is an expensive, complicated, and time-consuming process. The processes which, with proper control, can have produced low-nitrogen and low-oxygen vanadium on a small scale may be catalogued as: Reduction of chlorides, reduction of oxides, and dissociation of iodides.

Because purity of the end product depends upon purity of the reactants the first two process categories are similar. The dissociation process is limited principally by size of equipment and rates of reactions.

Since fused-salt electrorefining of titanium had definitely demonstrated ability to control gaseous impurities, it appeared that the same process could be applied to improve the quality of technical grade vanadium. This investigation was undertaken to ascertain the feasibility of using this method to produce a metal of greater purity than the present commercial vanadium metal. The specific object was to improve the ductility of the final product by removing oxygen and nitrogen.

The anode, or feed material, was vanadium metal having a Rockwell B hardness of 97 and containing, according to the producer, 99.5 per cent V, 0.30 Fe, 0.18 0_2, 0.03 N_2, 0.006 H_2, and 0.03 Cr.

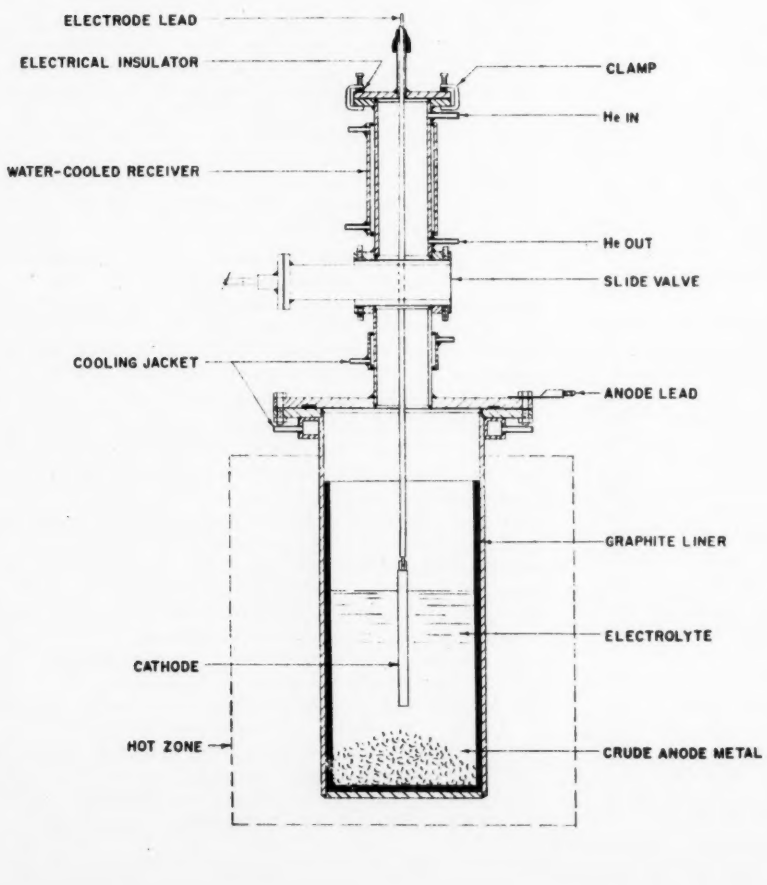
Experimental work was begun in 3 in. dia. cells. Subsequently, 6 in. dia. cells were used, then 12 in. dia. cells, in which the bulk of the tests were conducted. The electrolytic cells used were identical to those used for refining titanium metal, except that a graphite liner was used to minimize iron contamination of the bath. A receiving chamber and valve system permitted the introduction and removal of the cathode without disturbing the inert atmosphere of the cell proper. External heat was used to maintain the electrolyte at the operational temperature of approximately 800 deg. Centigrade.

Vanadium metal, crushed to $-\frac{1}{2}$in., was charged to the bottom for the anode. On the basis of experience gained in operating similar cells on other metals, the minimum ratio of the cathode to the anode area was fixed at 1 to 3. In anode areas exceeding the minimum, more operative stability was obtained. The cathode for the 3 in. dia. cells was a $\frac{1}{2}$in. titanium rod, whereas that used for the 12 in. dia. cells was a $\frac{3}{4}$in. dia. iron rod.

After initial studies in the 3 in. dia. cell, it was determined that sodium chloride with approximately 3.0 per cent vanadium as dichloride was used in this investigation. In the 3 in. and 6 in. cells, the dichloride was formed by feeding vanadium tetrachloride through a delivery tube submerged in the fused sodium chloride bath; the vanadium tetrachloride reacted with the vanadium metal in the bottom of the tube to form the dichloride.

Vanadium chloride was applied to the 60 lb. sodium chloride bath in the

Schematic drawing of cells used in fused-salt electrorefining of vanadium



12 in. dia. cells through the reaction of chlorine gas and a small amount of admixed hydrogen chloride with the granular anode metal in the cell bottom. The reaction of hydrogen chloride with the vanadium anode material was extremely slow. Hydrogen evolved from the hydrogen chloride passed from the chlorinator and through the bath, assisting in the purification of the sodium chloride. Off gas was permitted to escape from the cell through an oil bubbler.

The cathode, cleaned and burnished, was introduced into the cell, through the receiving chamber above the bath compartment. The receiving chamber was evacuated and charged with inert gas (helium), after which the cathode was lowered into the bath through a valve. Before use, the cathodes were stored in a drying oven under controlled low-humidity atmosphere. After the cathode placement was completed the voltage appropriate to the particular test was applied and the refining process conducted.

Upon completion of the run the cathode, bearing the product metal, was withdrawn into the upper cell chamber to cool the vanadium metal before final removal from the cell. Deposits of the metal were leached with a 2 to 3 per cent hydrochloric acid solution to dissolve the entrained salts and were then subjected to agitation in a high speed mechanical agitator to separate the metal crystals. Salt free metal crystals were washed with acetone to aid the rapid removal of moisture and were sized through the appropriate screens.

After the encouraging results of the initial research, the investigation was continued using the more versatile 6 in.-dia. cells. The electrolyte comprised fused sodium chloride and 1.6, 3.0, and 6.0 per cent vanadium present as dichloride. In general, the metal product improved in quality with succeeding runs. The best deposits of cathode metal were obtained when the electrolyte contained 3.0 per cent vanadium dichloride, the cell voltage was 0.7, and the effective anode area was at least three times the cathode area.

It was concluded that oxygen and nitrogen can be eliminated from vanadium metal by the fused-salt electrorefining technique. These gaseous impurities were reduced about two-thirds, hardness was reduced from 97 RB to a low of 35 RB, and the improved ductility of the metal permitted a 99 per cent cold roll reduction before cracking or failure.

SEPARATING NICKEL AND COBALT

A process has been investigated for preparing specification grade nickel (containing less than 1 per cent cobalt) by stripping it electrolytically from a nickel sulphate-boric acid solution and using the stripped eletrolyte for the preferential dissolution of nickel from basic carbonates of nickel and cobalt. The basic carbonates were produced at the plant at Nicaro, Cuba.

Determination of the optimum conditions for deposition of specification grade nickel indicated that the upper limit of cobalt concentration was 0.1 gram per litre. The pH, temperature, and concentrations of nickel and boric acid in the electrolyte were not critical. An aluminum cathode and two lead anodes were used at a cathode current density of 1.2 amperes per sq. decimeter. Determination of the optimum conditions for preferential leaching of nickel from Nicaro basic carbonates indicated that extraction of cobalt was minimum at approximately pH 4, 65 deg. C., 20 grams per litre (g.p.l.) of nickel, and 40 g.p.l. of boric acid. Aeration depressed the extraction of cobalt.

A cyclic system, incorporating the results of the preceding electrowinning and dissolution steps, showed that leaching at pH 4 did not extract as much nickel as could be stripped efficiently in the electrolytic cell. A pH of 3 proved staisfactory, but owing to a gradual build up the cobalt content of the electrolyte approached the upper limit for deposition of specification grade nickel by the end of the test. Leaching at pH 3 changed the nickel-cobalt ratio from 97:1 in the basic carbonates to 36:1 in the residue. Energy consumption was 1.5 kW.-hr. per lb. of nickel. Excellent recoveries of nickel and cobalt from the dissolved leach residue were obtained by separating them with Dowex-1 anion exchange resin. Cobalt was complexed with chloride ions and eluted with water. (Report of Investigations 5543).

WASHING PROCESS FOR IRON ORE

A simple washing process recently developed by the Bureau for treating certain ores from Alabama iron deposits has proved commercially feasible and now is being used to provide a high quality concentrate for blast furnaces.

Known locally as " Dudley red iron ore," the deposits are near Dudley and Vance, in the Birmingham District. Their usefulness appeared uncertain because of clay-like materials mixed or interbedded with the iron. Working co-operatively with the United States Pipe & Foundry Co., and the University of Alabama, both at Tuscaloosa, the Bureau developed and tested a washing and desliming cycle to upgrade the ore. At this point, the Southeastern Coal & Iron Co., was convinced of the commercial possibilities and began its own research with the method. This culminated in construction of a 25 ton per hour pilot plant, since enlarged. Other informal co-operators in the research included the Republic Steel Corp. and the Woodward Iron Co. (Report of Investigations 5623, " *Concentrating Argillaceous Surface Iron Ore of Tuscaloosa County, Ala., by Washing* ".)

HIGH PURITY CHROMIUM AND YTTRIUM

Studies that culminated in experimental production of high purity chromium and yttrium metals by scientists at the Bureau of Mines, Albany, Oreg., Metallurgy Research Centre are described in two new technical publications.

Report of Investigations 5589, *High Purity Chromium by Electrolysis*, discusses a series of experiments in which chromium metal was deposited in ultra-pure form by passing an electric current through a hot solution of chromium trioxide. This study, part of long range research to obtain a better understanding of chromium's properties, contributed to the Bureau's production of ductile chromium wire which, in irradiated form, has been hailed as a promising weapon against cancer.

The Bureau found that high purity chromium can be made into sheets as well as wire, the report says, adding that this metal has superior ability to withstand effects of high temperatures, and thus should ultimately find uses in aviation, ballistics, and similar fields.

Report of Investigations 5588 is : *Preparation of High Purity Yttrium by Metallic Reduction of Yttrium Trichloride*. It describes experiments in which yttrium trichloride was reduced to extremely pure metal by reacting it with hot lithium or sodium metal in a crucible filled with inert gas. This investigation showed that high purity yttrium is ductile enough to be worked into a promising structural metal with potential uses in atomic reactors and missiles. According to the report, the Bureau is continuing research on production of high purity yttrium and its properties.

Copies of all these publications can be obtained from the Bureau of Mines, Publications-Distribution Section, 4800 Forbes Ave., Pittsburgh 13, Pa. Requests should specify the number and title of the report wanted.

TRACE ELEMENTS IN WATER

A new method for analysing waters for minute quantities of important elements dissolved in water is described in a U.S Geological Survey report.

The new method enables scientists to determine quantitatively about twenty-four elements in the single burning or arcing of a small quantity of residue from from an evaporated sample of water. Prior to the development of this method, direct measurement of minute concentrations of these elements has not been possible by standard chemical laboratory methods, as most of the substances occur in concentrations less than 100 micrograms in one litre of water (about 0.1 part in 1,000,000 parts of water). Major elements, such as calcium, magnesium, and sodium are determined by standard chemical tests as they generally occur in concentrations more than 1 part per 1,000,000.

Among the elements determined by the spectrographic method are silver, aluminium, boron, barium, beryllium, cobalt, chromium,caesium,copper,iron,germanium, lithium, manganese, molybdenum, nickel, phosphorus, lead, rubidium, silicon, tin, strontium, titanium, vanadium, zinc, and zirconium. These substances are now known to occur in many large rivers of the world that have been studied.

One of the principal values of the method is its extreme sensitivity. For example, as little as 1 part per billion of strontium (one millionth of a gram) can be measured quantitatively. Copper and silver can be determined with even greater sensitivity.

The method described consists of complete vaporizing of 12 milligrams of water residue and synthetic standards mixed with 6 milligrams of pure graphite powder using a direct current arc of 16 amperes. The spectrum from the burning of the sample is recorded on a photographic plate. After processing the plates, the intensities of selected spectrum lines are measured, and the concentrations of the elements are read from working curves prepared from standards.

Water Supply Paper 1540-A, " *Residue Method for Common Minor Elements*", is the first in a series of reports on this subject covering research work accomplished in the Survey's Water Resources Division Laboratories. Water-Supply Paper 1540-A, is for sale by the Superintendent of Documents, Washington 25, D.C., price 15c.

Metals and Minerals

Aluminium Versus Tin and Steel

Competition between the leading steel and aluminium producers in the U.S. for the can manufacturing market has led to the almost simultaneously development of major new products by both contestants.

Steel's weapon is a new type of tinplated steel about half as thick as the material currently used to make "tin cans" and priced well below conventional tinplate. It promises to cut the weight per can by roughly 50 per cent. This material is being introduced by the U.S. Steel Corporation under the name of "Ferrolite". It is claimed that the new material offers "proportionally greater strength" than conventional tinplate.

Tinplate is sold on a "base box" basis, which is a measurement of area, not weight. The new product is rolled so thin that it weighs only 45 lb. per "base box". Priced at $6.10, this is $3 lower than the price for standard tinplate weighing 100 lb. per box and 55 c. lower than that of the so-called standard tinplate in lighter weights. This is expected to give consumers a powerful incentive to use the new product.

The technique used for producing this very thin tinplate has not been revealed. According to the *American Metal Market*, however, trade sources suggest that the company is using a so-called "double reduction" process, putting the tinplate through a second cold reduction rolling after the strip has been tin-coated in the conventional manner. The suggestion is that the mill operators first make tinplate about 0.01 in. thick, with a half-pound tin coating, and that the final rolling reduces both steel strip and tin coating to about half its original thickness. This is only an assumption, however, and it is possible that the steel may be rolled down to the required thickness before the coating is applied. From the standpoint of the producers, a particularly welcome aspect of this new development is that, whatever the method of manufacture, the reduction in weight and cost is being achieved without reducing the thickness of the tin coating.

"Ferrolite" has been tested successfully in quart-sized motor-oil cans, the segment of the can business that began switching to aluminium two years ago, and also in cans for frozen concentrated juices, aluminium's current No. 1 target in this market. Can manufacturers have been awaiting it for months and have expressed some enthusiasm for it in testing. The announcement that it is now commercially available appears to have come rather sooner than had been generally expected.

"By leaping into the market with this new product at a sharply lower price," comments the *American Metal Market*, "the firm probably comes much closer to meeting the price of aluminium for can making". Prices of cans made of the new product cannot, however, be established until further tests and pilot plant runs are made by the can manufacturers. So far, "Ferrolite" is being made in only one tin coating—quarter pound—and is not being made at all in the form of black plate. This means, of course, that it will not be directly competitive with standard tinplate for those uses which require heavier tin coatings or black plate.

Granite City Steel Co. plans to be in production by April, 1961, with its own version of "thin" tinplate for can making, while other tinplate makers are known to be working on similar materials.

Aluminium's weapon is a new can top that a consumer can open by pulling on a tab, thus eliminating the use of a can opener. It was developed by Alcoa and United Shoe Machinery Corporation and is being test-marketed on frozen orange juice cans by Minute Maid Corp. in Providence, Rhode Island. This device, according to Alcoa, could easily become the standard opening device for metal cans. In addition, the quick-opening features would allow many packers to consider cans for use in vending machines.

The can industry has always been one of steel's biggest markets, accounting in the U.S. for about 9 per cent of all steel sold, and is by far the largest outlet for tin. It is also one of aluminium's fastest growing markets. The production of aluminium cans expanded from 30,000,000 units in 1958 to 200,000,000 last year and appears to be making further headway this year—all at the expense of tinplate. Alcoa and Reynolds Metals state that they are currently offering aluminium to can makers at prices "fully competitive" with those of conventional tinplate. In fact, Alcoa claims that its price for aluminium can tops is lower than that of tinplate tops, one reason being that aluminium tops do not require to be covered with a protective coating.

Of the two developments, "Ferrolite" is likely to have the more immediate impact since it has already become commercially available, whereas production equipment does not yet exist to make the tab-opening aluminium tops in large quantities.

In the long-term, the world's appetite for metal containers should be large enough to provide both tinplate and aluminium with steadily rising markets, but increased competition from plastics in some sectors must be anticipated. This year plastics are expected to displace about 20,000 tons of tinplate in the U.S.A., chiefly in the production of detergent containers.

The battle between steel and aluminium has also taken the form of price cuts in the electrical conduit field. Some two weeks ago makers of galvanized steel conduit cut their prices by 5 per cent. Now the leading aluminium producers have followed suit. The new cut reduces quotas on aluminium electrical conduit below the level that had been maintained up to July 31. It is the first instance of a price weakness on a major aluminium mill product since August 1, when a wage increase went into effect following the long-term labour contracts signed last autumn, and the industry's leading producers raised prices on most aluminium items.

LONDON METAL AND ORE PRICES, SEPT. 8, 1960

METAL PRICES

Aluminium, 99.5%, £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £190 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 10s. 6d. lb.
Cerium (99%) net, £15 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt. 12s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold. 250s. 5d.
Iridium, £20/£23 oz. nom.
Lanthanum (98%/99%) 15s. per gram
Magnesium, 2s. 2¼d./2s. 3d. lb.
Manganese Metal (96%/98%) £275/£285
Nickel, 99.5% (home trade) £600 per ton
Osmium, £18/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £28½/28¾
Quicksilver, £69½/£70 ex-warehouse
Rhodium, £43/£45 oz.
Ruthenium, £14/£16 oz. nom.
Selenium, 50s. 0d. per lb.
Silver, 79¼d. f. oz. spot and 79¼d. f'd
Tellurium, 28s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis			20s. 6d./21s. 6d. per unit c.i.f.
Beryl (min. 10 per cent BeO)			240s./245s. per l. ton unit BeO
Bismuth			65% 8s. 6d. lb. c.i.f.
			18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—			
Rhodesian Metallurgical (semifriable 48%)	(Ratio 3 : 1)		£15 5s. 0d. per ton c.i.f.
" Hard Lumpy 45%	(Ratio 3 : 1)		£15 10s. 0d. per ton c.i.f.
" Refractory 40%			£11 0s. 0d. per ton c.i.f.
" Smalls 44%	(Ratio 3 : 1)		£13 5s. 0d. per ton c.i.f.
Baluchistan 48%	(Ratio 3 : 1)		£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1)			
	Nb_2O_5 : Ta_2O_5		180s./185s. per l. ton unit c.i.f.
Fluorspar—			
Acid Grade, Flotated Material			£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)			156s. 0d. ex. works
Lithium Ore—			
Petalite min. 3½% Li_2O			50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite(min. 3½% Li_2O			50s. 0d./55s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O			75s/85s. per ton f.o.b Beira
Magnesite, ground calcined			£28 0s./£30 0s. d/d
Magnesite Raw (ground)			£21 0s./£23 0s. d/d
Manganese Ore Indian—			
Europe (46%-48%) basis 60s. 0d. freight			73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)			69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)			nom.
Molybdenite (85%) basis			8s. 11d. per lb. (f.o.b.)
Titanium Ore—			
Rutile 95/97% TiO_2 (prompt delivery)			£28 0s. 0d. per ton c.i.f. Aust'n
Ilmenite 50/52% TiO_2			£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)			155s./161s. per unit c.i.f.
Vanadium—			
Fused oxide 95% V_2O_5			8s./8s. 11d. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2			£16/£16 10s. ton c.i.f.

Electrical conduit is among aluminimum's fastest growing markets. According to Reynolds Metals, aluminium's share of the total market is now estimated at between 10 and 15 per cent

TITANIUM PRICES CUT

On the eve of the SBAC Exhibition at Farnborough, Imperial Chemical Industries Ltd., Metals Division, announced further major reductions in the basic prices of their wrought titanium. The cuts, affecting deliveries after November 1 next, range from 15 per cent for rod, extrusions and commercially pure sheet to 10 per cent for plate, wire and alloy sheet. As typical examples, hot rolled plate, 1 in. thick, is reduced from 54s. to 49s. per lb.; sheet (commercially pure) 8 ft. x 2 ft. x 20 gauge from 85s. to 73s.; forged bar and billet, 8 in. dia., from 55s. to 48s.; rolled rod, 1 in. dia., from 66s. to 56s.; and extrusions from 105s. to 90s.

Titanium is being incorporated in increasing quantities in modern high-performance aircraft. I.C.I. have also successfully developed its use in other industries, notabiy chemical engineering. The consequent increase in demand, and technical improvements resulting from intensive research and development work, have made this substantial price reduction possible. It is the fifth reduction since I.C.I. began selling wrought titanium six years ago, and it brings prices down to well under half their 1954 levels. This reflects I.C.I.'s declared policy of reducing the price of wrought titanium whenever this can be justified by greater throughput.

MANGANESE FREIGHT CUTS

The only item of interest in an otherwise uneventful manganese ore market has been a reduction in the Conference rate from India by 7s. 6d. to 60s. per ton. The last time the freight rate changed was in June, when it was reduced by 5s. to 67s. 6d.

Buying interest does not yet appear to have got into its stride after the holidays. It is thought that in the course of the next few weeks consuming countries will have to begin seriously considering covering their anticipated requirements for next year. How this will react on a market which has for so long been in the doldrums remains to be seen.

U.K. imports of manganese ore during July totalled 46,132 tons, lifting the tonnage brought in over the period January to July to 269,946 tons, compared with 188,284 tons in the corresponding period of last year.

JAPANESE ALUMINIUM PLANS

Three Japanese aluminium refining companies have submitted plans to the Ministry of Trade to expand Japan's primary aluminium output to 218,890 tons by the 1962-63 financial year. During the current financial year production is expected to total 137,500 tons. These plans showed that the Japan Light Metal Co., Showa Denko, and the Sumitomo Chemical Co. were proposing to increase their outputs to 91,300, 70,007 and 57,583 tons respectively.

Mitsubishi Chemical Industry Co. is also planning to start production of primary aluminium and is negotiating a tie-up with Reynolds Metals. If agreement is reached, it will become Japan's fourth producer.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

Markets have shown no definite tendencies over the last week. In the case of copper, strike news is awaited from Chile, price news from the U.S. and general news from the Congo. In the case of tin, the full implications of the I.T.C.'s decisions are still being digested. In the case of lead and zinc, markets are waiting on the outcome of next week's Geneva Conference.

COPPER STOCKS GROW

The copper market has continued active but with relatively minor price movements and with the maintenance of a small contango, the size of which has called for comment in view of the continued increase in stocks which again last week advanced by a further 1,288 tons to a total of 8,399 tons. Most observers feel that with stocks of this magnitude the contango should be several pounds. Consumer demand has tailed off, and with copper available in the U.S. at very much below the quoted prices, most experts consider that a reduction in the customs smelter quotation is imminent.

At the moment export copper is available from the U.S. at around 30 c. per lb., whilst in the domestic market metal is on offer at about 31½ c. per lb. The intake price for No. 2 scrap is 25½ c. per lb. which is equivalent to 31 c. per lb. for metal delivery in three months.

The Belgians have reduced their price again by approximately ½ c. per lb. to the equivalent of 29½ c. per lb. New York or Antwerp, and in Canada a reduction of 1 c. per lb. has been made but the price level in that country is still on a level with the highest U.S. quotation, i.e., 33 c. per lb. by the producers.

There has been no news from either Chile or the Congo to have any appreciable effect on the market and opinions remain very divided upon developments in these two producing centres.

TIN STEADY ON AUTUMN EXPECTATIONS

The tin market has remained steady, but consumer interest has not been at the same level as in previous weeks although dealers are now hoping that after Labour Day in the U.S. demand from there will show some increase. Stocks in the U.K. fell a further 368 tons to a total of 9,204 tons and it is felt that this tendency may continue. Exports from Penang during August rose to 8,268 tons as compared with 7,185 tons in July and little more than half the tonnage a year ago.

On Thursday the Eastern price was equivalent to £808 per ton c.i.f. Europe.

LEAD WEAKER

The lead market has shown a slightly weaker undertone than the other metals. This may have been caused by the Spanish Ministry of Commerce having announced that as from July 29 last, certain exports will become eligible for refunds of taxation and that base metals are included in this list — should this mean a resumption of exports of Spanish lead, the market may suffer accordingly. The consumption remains good in Europe and the U.K. but stocks continue to pile up even apart from the 10 per cent being withheld by producers and there are few who would subscribe to the possibility of a firm market in the last few months of 1960.

U.S. ZINC CONSUMPTION DISAPPOINTS

The zinc market has remained practically unaltered but consumption in the U.S. is disappointing and doubts are now being expressed whether much improvement will be seen during this autumn. The fact that the import quotas into the U.S. for zinc have still not been filled in the majority of cases indicates that although the supply position in the rest of the world is known to be easier, no surplus is accumulating.

The Board of Trade announced on Monday that they were offering a further 1,600 tons of zinc for delivery and pricing between October, 1960, and March, 1961, consisting of 1,000 tons of special high grade zinc and 600 tons of high grade zinc. As was to be expected, this small tonnage had no effect on the market. This should leave U.K. stocks still for disposal at a figure slightly below 40,000 tons.

PRESIDENT VETOES SMALL SCALE SUBSIDY BILL

As was expected (see page 281), President Eisenhower vetoed the Bill designed to subsidize small scale lead and zinc producers in the U.S. and as Congress has now adjourned, nothing more will be heard on this subject until after the Presidential Elections and the installation of the new Administration but in the meanwhile, such countries as Canada, Mexico, Peru and Australia continue to make it clear to U.S. officials that they would consider any additional interference with imports of lead and zinc into the U.S. would have serious effects on their economies and would be viewed as an unfriendly act.

Closing prices are as follows.:

	September 1		September 8	
	Buyers	*Sellers*	*Buyers*	*Sellers*
COPPER				
Cash	£234	£234½	£236	£236½
Three months ..	£234½	£234¾	£236	£236½
Settlement ..	£234½		£236½	
Week's turnover	12,025 tons		11,325 tons	
LEAD				
Current ½ month	£71	£71½	£70½	£70⅝
Three months ..	£71½	£71⅝	£70½	£70⅝
Week's turnover	5,125 tons		4,350 tons	
TIN				
Cash	£802½	£803	£799½	£800½
Three months ..	£802½	£803	£799	£799½
Settlement ..	£803		£800½	
Week's turnover	470 tons		515 tons	
ZINC				
Current ½ month	£85½	£86	£86⅛	£86⅜
Three months ..	£85½	£86	£86⅛	£86⅜
Week's turnover	3,350 tons		1,925 tons	

Mining Finance

R.S.T. Dividends may be Cautious

The salient points of the year's operating results for the Rhodesian Selection Trust group of Northern Rhodesian copper mines are shown in the accompanying table. They are taken from the June quarterly reports which completed the companies' financial years. It had already been obvious from previous quarterlies that profits would be well up on those for the preceding year owing to larger metal sales and a higher copper price which, as may be seen, comfortably outweighed an increase in unit costs. The rise in the latter would, of course, have stemmed partly from the higher price because the costs include the royalty payments to the British South Africa company and these are based on the copper price.

	Year to June 1959	Year to June 1960
Roan Antelope		
Sales (tons)	80,617	91,051
Est. Profit Before Tax (£000)	4,860	6,839
Revenue per ton (£000)	219.5	245
Costs per ton (£000)	147.5	158.7
Mufulira		
Sales (tons)	87,521	103,040
Est. Profit Before Tax (£000)	6,374	8,749
Revenue per ton (£000)	228.4	248.8
Costs per ton (£000)	144.8	156.3
Chibuluma		
Sales (tons)*	19,073	22,485
Est. Profit Before Tax (£000)	1,145	1,784
Revenue per ton (£000)	216.9	239.5
Costs per ton (£000)	143.5	148.8

* *Also sold* 715 *tons of cobalt against* 741 *tons in* 1958-59.

The next stage in the group's affairs will be the publication early next month of the net earnings after tax, the final dividends and the allocations to reserves. The interim dividends of Mufulira, Roan Antelope and Rhodesian Selection Trust itself were all increased by 50 per cent. The optimists are naturally hoping that the finals will also be raised by this amount, but it would be unwise to be quite so hopeful in present circumstances. The directors might have been willing to be generous if the prospects for 1960-61 were as good as, or better than, those for the past year. But they are not.

For one thing there is now a lot of copper about. Production is running well ahead of consumption. Copper has come down to £235 a ton in London. Stocks of the metal in the London Metal Exchange's official warehouses have shot up from 1,674 tons at the end of April to 8,399 tons. It thus looks as though the Rhodesian producers may soon have to reintroduce production cutbacks to avert an appreciably lower metal price than they obtained in 1959-60.

At the moment the price is being sustained (apart that is from a little intervention in the market by the producers themselves) by the chance that production in Chile may once again be affected by a labour strike. Wage negotiations are in progress there. If an amicable settlement is reached then copper would almost certainly fall subject only to any mounting uncertainties surrounding the important slice of supplies that comes from the Union Minière properties in the Congo's Katanga province, which so far have remained largely unaffected by the collapse of central government.

	1958-59		1959-60		Price	Yield*
	Interim	Final	Interim	Final†		%
Roan Antelope	3d.	7d.	4½d.	10½d.	6s. 6d.	12.0
Rhod. Selection	4d.	9d.	6d.	1s. 1½d.	10s. 6d.	9.7

* *On the projected* 1959-60 *payments before double tax relief but after allowing for Rhodesian tax.*

† *Based on assumption of* 5 *per cent increase on final for previous year.*

The Chilean affair will probably have been decided one way or another by the time the R.S.T. directors, under the chairmanship of Sir Ronald Prain, sit down to consider the 1959-60 dividends. In the table above last year's payments before Rhodesian tax are given together with those for 1959-60 on the assumption that the finals were to be raised by 50 per cent. This gives a maximum prospect some little way below what the actual payments will probably be.

There is no market in the shares of Mufulira and Chibuluma. R.S.T. has a 64 per cent stake in each of them. Chibuluma is not yet paying dividends. It still has £1,954,000 to repay of its debt to the United States Government. This should be cleared off by, say, June 1962.

CHARTERED RAISES ITS INTERIM, BUT ADDS A RIDER

As already mentioned, the British South Africa company, or Chartered as it is generally called, receives royalties on Northern Rhodesia's copper production and by June 30 these mineral royalties had brought in £8,771,000 during the first nine months of the company's financial year against £6,718,000 in the same period of 1958-59. So the market was hardly surprised when Chartered raised its interim on the 15s. units from 1s. 6d. to 2s., but it was a little disappointed with the qualification accompaning the announcement to the effect that " the directors wish it to be known that this increase has been made in order to provide a better

LONDON MARKET HIGHLIGHTS

South African Gold share prices maintained their new-found firmness up to Wednesday evening of last week despite the rapid deterioration in the Congo situation. Actual business failed to show much expansion but because of a persistent shortage of stock price gains were often very sharp. Johannesburg provided most of the impetus but it was noticeable that when that centre was closed on Monday for Settlers Day there was no backsliding in share prices.

Several features emerged among the shares of the newer mines. The imminence of the O.F.S. dividend declarations was a bullish factor, particularly in St. Helena which spurted 4s. 4½d. to 75s. 7½d. in three days. The shares had previously been firm following a monthly return which was outstanding in a generally good batch. This showed a rise of £47,139 to a record profit of £397,895, the move being accompanied by an increase in the milling rate of 12,000 tons to 179,000 tons. The other notable August return was that of Harmony which reported a surplus £31,362 higher at a best-ever £585,352.

Other good spots in the O.F.S. market last week were President Brand 2s. 9d. up at 65s. 1½d. and Western Holdings which advanced 6s. 10½d. to 135s. 7½d.: the latter being sought after not so much on dividend hopes but rather on talk of high development values.

Western Rand issues also had their share of attention particularly on Wednesday when Western Deep announced its high value reef intersection. The company's " A " shares jumped 2s. 6d. to 44s. 9d. and West Wits were 1s. 10½d. up at 61s. 3d. in sympathy. A feature elsewhere was provided by Leslie Gold which jumped 1s. 6d. to 17s. 9d. on the good value shaft strike. Attention also returned to the Finance group where Gold Fields (68s.), Anglo American (156s. 3d.) and Union Corporation (56s.) were singled out by local investors.

The excellent results from the Rhodesian Selection Trust group coupled with continued hopes of high final dividends from Rhodesian Anglo American and Rhokana next month provided a favourable background for the Copper market. But Congo politics dampened any real forward movement until Wednesday afternoon when a more hopeful reading of the Congo situation was taken. Tanganyika Concessions rallied 2s. to 32s. 6d. and Nchanga moved up 1s. 7½d. to 56s. Bancroft improved further to 19s. and there was talk of a maiden dividend being in the offing.

Among Miscellaneous Golds, Australians remained quietly firm, Gold Mines of Kalgoorlie (8s.) being helped by the chairman's mention of " spectacular " gold values. Ghana issues, however, were subdued by the statutory increase in minimum wage rates in that country. Ashanti eased to 18s. 1½d.

Lead-zincs continued to attract little interest. Consolidated Zinc made a rather belated response to the Bell Bay acquisition news by jumping 1s. 9d. to 79s. 3d., but soon reacted to 77s. 6d. when profit-takers appeared. Tins were also subdued but the undertone of the market stayed firm enough. Ayer Hitam improved to 26s. 6d. and news that dredging operations were to be resumed lifted Kent by 7½d. to 3s. 7½d.

balance between interim and final payments ".

Chartered's income from its substantial and growing investment portfolio is also expected to be up in the current year. So there is still a tendency to hope that, even allowing for further allocations to reserves in order to extend these investments, the company will pay more for 1959-60 than last year's total of 6s. Providing that nothing particularly adverse happens between now and the date of the declaration next February, a final of 4s. 6d. is at present a minimum market expectation. This would yield 8.7 per cent on Chartered at 75s.

LESLIE'S FIRST SHAFT REACHES THE REEF

Leslie Gold Mines has struck the Kimberley reef in its No. 1A shaft at a depth of 1,476 ft. below the collar. Sampling round the whole perimeter gave 80.9 dwts. gold per ton over a width of 5.6 inches, equal to 453 inch-dwts. This is a satisfactory enough value for the Kimberley reef in this new Kinross gold field situated well to the east of the Rand. It conforms very closely with the assay of the borehole core that was originally brought up on the site of this shaft. The fact that the reef was not faulted and appeared round the entire perimeter of the shaft is also encouraging.

Leslie's other shaft, No. 1, is situated very close to 1A. Full-scale sinking of it was scheduled to start last month. So it may reach the reef about the end of the year. In the early days of reef development at Winkelhaak, the only producing mine on this field, average reef values of 300-odd inch-dwts. were obtained. These have now improved to over 500 inch-dwts. This mine, incidentally, which started milling in 1958, is expected to declare its maiden dividend this month.

Leslie 10s. shares rose to 17s. 6d. on the news. They were up to 21s. 9d. earlier this year.

WESTERN DEEP CUTS V.C.R. AGAIN

Western Deep Levels has sampled 15 ft. of Ventersdorp Contact reef in a crosscut from the No. 3 shaft system with the high-value results for this particular horizon of 59.5 dwts. gold per ton over a channel width of 23.83 inches, or 1,418 inch-dwts.

The reef was intersected in a crosscut on 66 level some 6,000 ft. below the surface at a point 1,183 ft. to the north of the shaft system. The reef dipped in a south-easterly direction at 31 degrees.

Previous intersections of the V.C.R. in the shafts of this Anglo American group mine in the Far Western Rand have given 315 inch-dwts. at 5,599 ft. in the No. 2 main vertical shaft and 495 inch-dwts. at 5,549 ft. in the No. 2 ventilation shaft.

WESTERN MINING AND GREAT WESTERN

Western Mining Corporation, which has various mining interests in Australia, suffered a decline of £A53,064 in its net profit for the year to last March to £A255,380. The reduction was mainly due to the disappointing position of Great Western Consolidated and the consequent fact that interest of £A57,132 chargeable for the year has not been brought into Western Mining's accounts. Dividends have nevertheless been maintained at 1s. Australian per 5s. share which takes £A189,435 of the net surplus. The annual meeting took place in Melbourne this week.

Formerly Western Mining carried forward the substantial amount of £A951,672, but this has now been reduced to £A67,617. This has been brought about by the transfer of £A950,000 to investments and investigations reserves, a move to provide against losses on investments and out of which unsuccessful exploration and development expenditure can be written off. It is stated that losses are anticipated on Great Western if that concern ceases operations in about two year's time as is at present indicated.

At the Great Western meeting this week, the chairman, Mr. G. Lindesay Clark, who is also chairman of Western Mining, said that Great Western had almost completely discontinued exploration owing to lack of funds, a position which had been reached despite further loans from both Western Mining and the Western Australian Government. He added that Great Western's joint application with Western Mining to mine iron ore in the Yilgarn district was still being considered by the State and Federal Governments.

Western Mining has a stake in Gold Mines of Kalgoorlie whose results were reviewed here on August 19 and is also branching out into bauxite, the raw material of aluminium of which trial shipments are being made to aluminium producers in Japan. The shares at 9s. 9d. yield 8.2 per cent after allowing for the exchange loss to U.K. holders.

TONGKAH HARBOUR'S SEA LEASES

At the request of shareholders the directors of Tongkah Harbour Tin Dredging have issued an up-to-date appraisal of the company's technical position. The main findings are that the estimated life of the Ronpibon dredge is approximately 20 years, but that at this stage it is impossible to give any estimate for the sea leases which form such a large and intriguing section of this company's activities. These leases are located some six miles distant from Bhuket Island off the west coast of Siam and are in the open sea. They are being worked by the company's new sea dredge which is giving good-value results whereas the drilling programme for various reasons was considered to be unsatisfactory.

The Tongkah monthly return, included with those of other London Tin group companies, is now giving separately that part of the output which comes from the sea dredge. Thus, in August it accounted for 100¼ tons of the 132¼ tons of tin concentrates produced. The directors say that explanatory comments will be added to the returns should there, for instance, be a "complete change of location in operation". Shareholders will also be advised as and when any additional information about the potential ore reserves in the sea leases becomes available.

Malayan Dredges Restart.—The ending of tin quotas has brought the announcement that Malayan Tin Dredging's Number 6 dredge, closed down by restrictions since August, 1958, was restarted at the beginning of this month in the old Batu Gajah area. This area is believed to be nearly worked out, there being only 70 acres of virgin ground remaining. The company currently has three dredges working in the Kampong Gajah area, where 2,175 acres of virgin ground remain to be dredged. Kent (F.M.S.) Tin Dredging has also announced its intention to restart the company's dredge by about mid-October. It has been on care and maintenance since August, 1958.

Half Year Results for Rio Algom.—The combined operating results for the mines in the Rio Algom group (Algom Uranium, Milliken Lake, Northspan, and Pronto) for the first six months of this year disclose a net profit of $15,201,000 compared with $6,349,000 in the corresponding period a year ago. Tonnage milled shows a slight reduction at 3,019,000 against 3,226,000. Gross revenue is virtually unchanged at around $72,000,000 and the increase in net profit is accounted for entirely by a reduction in operating costs of just on $10,000,000 in the six-month period. These economies reflect the closing down of Pronto's operations on April 30, and further economies can be expected with the closing down of Northspan's Lacnor mine on June 30 last. These closures have been designed to meet as economically as possible the government's contract stretchout provisions.

Government G.M.A. Capital Repayment.—Government Gold Mining Areas announce a further capital repayment (the sixth) of 6d. per share payable on September 16.

Board Changes

Mr. C. R. Benzecry and Mr. P. S. Hawkings have been appointed directors of London Australian and General Exploration Co. Mr. A. H. Williams and Mr. H. A. A. Mallett have resigned.

*

Mr. A. Hedley Williams has resigned as director and chairman from the board of Klerksdorp Consolidated Goldfields.

*

Mr. Ian L. Patterson is to resign from the board of Clutha River Gold Dredging on September 30, owing to other business activities, and Mr. Robert Michael has been elected a director.

The title of Bulletin No. 5 published by the Ministry of Labour and Mines, Geological Survey Department, Northern Rhodesia is "Carbonatites of the Rufunsa Valley, Feira District". We regret that this was incorrectly given in our issue of July 22. We have also been informed that Bulletin No. 3 "The Geology and Mineral Resources of Northern Rhodesia", by W. H. Reeve will be published early in 1961.

EDITORIAL VACANCY

Metal mining or quarrying engineer required to fill a vacancy on the editorial staff of a monthly technical journal covering the metalliferous mining and quarrying industries. Applicants should be under 30 years of age, possess an A.R.S.M. or equivalent and have had practical experience either in the U.K. or abroad. Writing ability is desirable as the job entails preparing descriptions of mines and quarries visited and editing contributed articles. Details of training and past positions to Box No. 677, *The Mining Journal Ltd.*, 15 Wilson Street, Moorgate, London, E.C.2.

MINING MISCELLANY

Dominion Engineering Company of Montreal has received an order from Algoma Steel Corporation, for the erection of a six-stand wide strip mill, costing about £11,000,000, which is to extend Algoma's present bloom and plate mill. The new mill will produce hot rolled sheets and light plates to a maximum width of 96 in., and is reported to be the largest rolling mill of its type to be made in Canada.

*

The first shipment of iron ore will leave Port Cartier, Quebec, early in 1961, after three years of construction development of the Lac Jeannine iron deposit by the Quebec Cartier Mining Co., wholly-owned by U.S. Steel Corporation. Quebec Cartier, said to be the largest project of its kind in the world, will produce up to 20,000,000 tons of crude ore annually.

*

The Chagres copper smelter, in the province of Aconcagua,, 150 km. north of Santiago, owned by "La Disputada", has re-started activities, after being inactive for ten years. The smelter will be supplied with ores from the company's copper mine near Santiago, and from "El Cobre" and "El Soldado", two other medium-sized copper mines in the province of Santiago.

*

It is reported from New York that the Anaconda Co. has temporarily halted production of zinc ore in the Butte area, because of the slow market for zinc, and the ample supplies in hand at Anaconda and Great Falls, Montana reduction plants.

*

The West German news agency VWD reports that a consortium of coal mine associations is planning the building of a hydraulic pipeline to transport coal from the eastern Ruhr area to Regensburg, Bavaria. From there it could be sent to other parts of Bavaria, and to Austria by river transport on the Danube. It is estimated that, if the diameter of the pipeline were 0.40 m., about 3,000,000 tons annually could be transported this way. The co-operation of the Consolidated Coal Co. of Pittsburgh has been assured. (This company has been transporting coal by hydraulic pipeline since 1957, see *M.J.*, June 3, p. 646.)

*

The Swiss company Eurinvest S.A. is to have a 49 per cent interest in the Spanish firm Arlos S.A., which will exploit fluorspar deposits in Spain.

*

Rhodesia Alloys is to expand its ferro alloys plant in Gwelo at a cost of £1,250,000. The work will take about two years to complete and its completion will coincide with the reduction in electricity costs. This expansion will roughly double the present output of low carbon ferro-chrome, the main product of the present refinery, and provide employment for many more Europeans and Africans. The principal shareholders in Rhodesia Alloys are John Brown and Co. of Britain, Rhodesia Anglo American and an investment subsidiary of the British South Africa Co., and the Societe d'Electro Chimie of France.

The Cabinet of New South Wales has approved new royalty conditions to apply to leases held at present by two companies prospecting in the Cobar area, Cobar Mines Pty., and Enterprise Exploration Co., providing that all leases come under the control of Cobar Mines (a subsidiary of Broken Hill South), who are negotiating to buy the interests of Enterprise Exploration Co. (a wholly-owned subsidiary of Zinc Corporation). The two companies have spent over £A.1,000,000 between them. Royalty is to be payable on the basis of net profits at the rate of 2 per cent on the first £A.100,000 of net profits, increasing at the rate of 1 per cent on each additional £A100,000 of net profits, up to a maximum of 8 per cent. No royalty to be payable until December, 1971, or until annual net profits exceed £A.250,000, whichever occurs last. This concession is to apply only where the value of copper produced is more than half the value of total mineral production from the mines.

*

Two U.S. companies have applied to the government of Trinidad and Tobago for permission to survey iron ore deposits in the Northern Range.

*

The Governments of Pakistan and the U.S.S.R. are to hold preliminary discussions in Karachi in the near future to explore the possibility of Soviet assistance in the exploration of Pakistan's oil and mineral resources.

*

The Brixlegg mining concern in Austria has received an interest-free loan of about £100,000 from Austria's Nationalized Industry Investment Fund for the expansion of its electrolysis unit and nickel sulphate plant. Another Austrian mining company, the Mitterberg copper concern, has received a similar loan of about £25,000 to enable it to continue development of its Hoffnung mine.

*

The U.S.-owned Compania Minera de Guatemala has resumed production and exports of lead and zinc concentrates from its stockpiles. Export tonnage figures for Guatemalan ores and minerals in 1959 were: lead concentrates, 5,721.91; antimony concentrates, 65.77; chrome ore, 452.39. Local consumption amounted to: lead ore, 5.56 tons; lead concentrates 5.21; pig lead, 56.50. By government order dated June 10, 1960, the Hanna Coal and Ore Corp. of U.S. were granted exploration rights for three years in the Department of Izabel. The company will prospect for nickel, cobalt, chrome and iron minerals. The Guatemalan company, Arenas Titaniferas del Pacifico S.A., who were granted rights to exploit the mineral contents of the Pacific beaches last May, are believed to be beginning operations at Puerto San Jose.

*

Hungary's first high pressure coal briquette factory has been opened at Hidas, County Baranya. The factory cost over £2,000,000 and has a daily capacity of 400 tons.

The Northern Rhodesian Mines Department Annual Report for 1959 states that annual production has been a record one for copper, cobalt, manganese, gold, silver and limestone. Of the total value of all minerals produced, £125,529,941, blister and electrolytic copper accounted for £117,033,169. The increase in total value of £48,405,709 was due to increased production and to the improvement in the copper price throughout 1959. From July 1, 1959, valuation of copper was based on f.o.r. at mine price; it had been based previously on the monthly average quotation on the L.M.E. for standard copper (electrolytic). This change in computing values caused a lowering in the value of production by about £6,000,000. During 1959, 56,155 tons of sulphuric acid, estimated value £336,930 was produced.

*

The Export-Import Bank of Washington have approved a credit of $15,600,000 to finance the purchase of U.S. equipment, materials and services by Compania de Acero del Pacifico, S.A. for developing the Algarrobo iron ore deposits in Atacama Province, Chile. This is the largest known orebody in Chile and is one of the planned reserves to supply the company's Huachipato steel mill near Concepcion. Eventually over 75,000,000 tons of ore will be available.

Personal

International Minerals and Chemicals announce that Mr. William T. Bradley has been appointed a director and will succeed Mr. Edward F. Perkins as managing director with effect from September 1, 1960. Mr. Robert E. Ford has also been appointed a director of the company.

*

Mr. Frank Wilson has left his position with Michigan Gt. Britain, and is now with Witlock Bros.

*

Mr. Charles Dodd is now Press Officer of the Cementation Group.

*

Mr. D. G. Hemmant has tendered his resignation and will not be returning to Powell Duffryn Technical Services at the conclusion of his secondment to the British Mining Equipment Export Association. Mr. R. Turner, who has acted as managing director during Mr. Hemmant's absence, has been appointed the sole managing director of the company.

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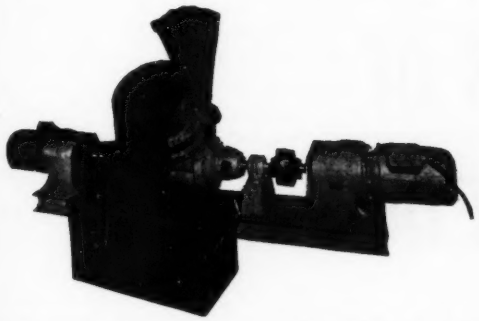

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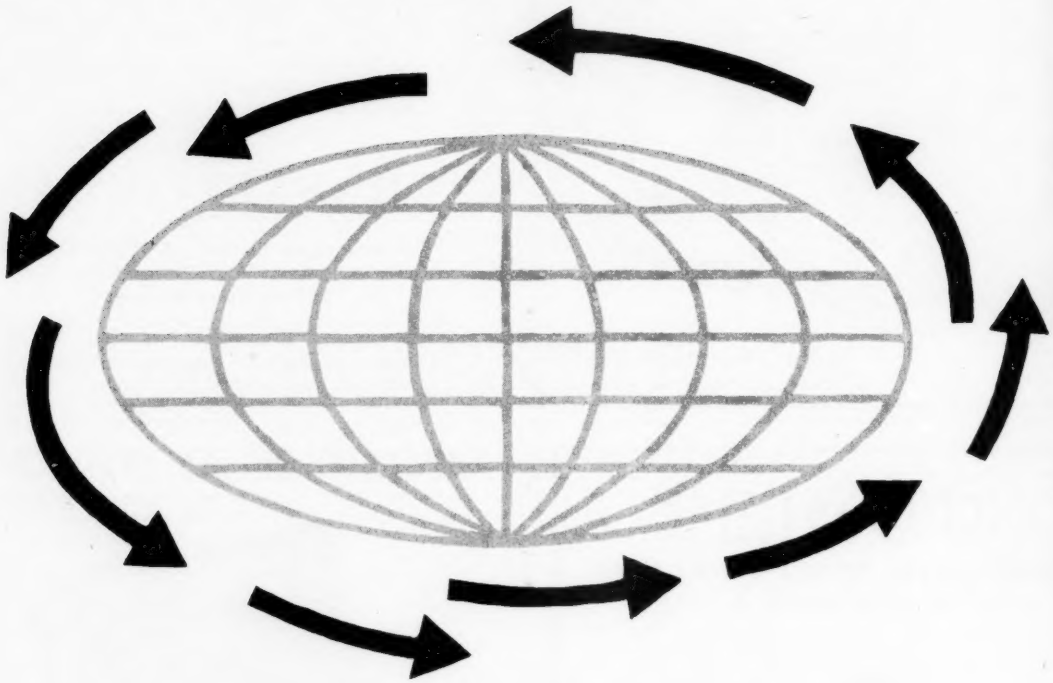

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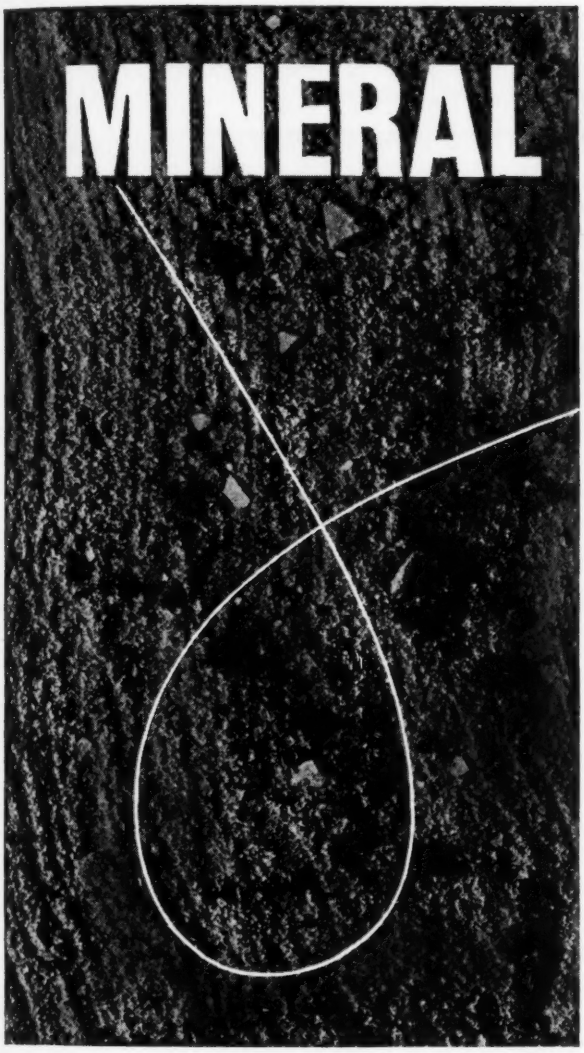

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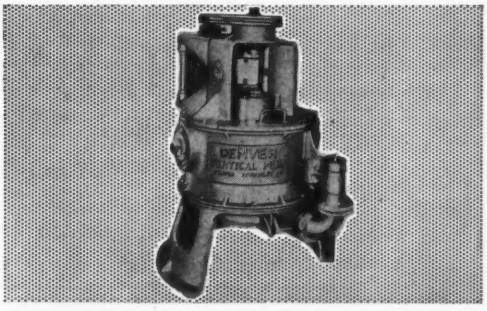

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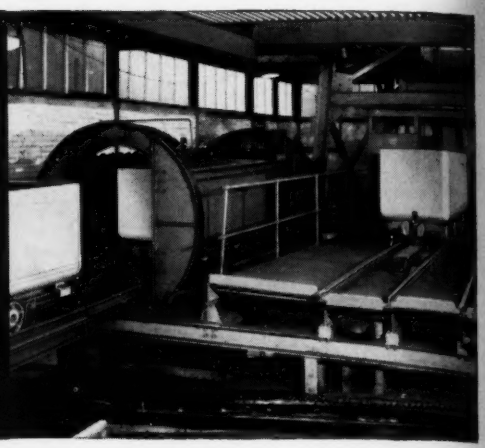
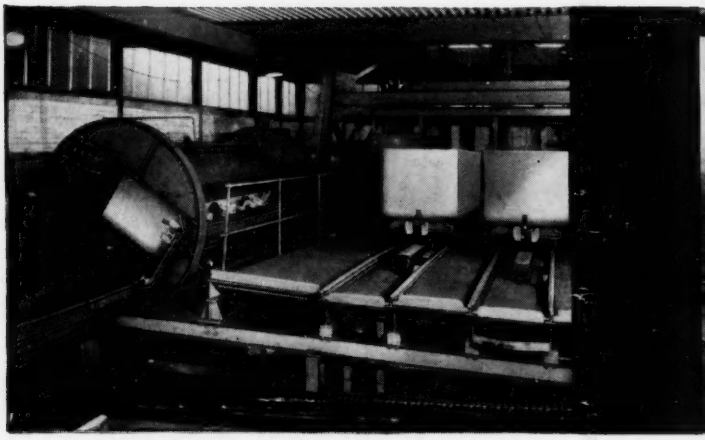
2½ ton mine car being rammed into the cage. One man at the desk deals with the whole output of this shaft.



The full mine car in the tippler has just pushed out the one now on the traverser. An empty mine car is held on the front stops of the ram.



The 2½ ton mine car in the tippler is discharging its coal: two empty mine cars stand ready on the decking rams. A reversible plate belt below the tippler deals with coal or stone.

The two ram heads are shown here with the back stops in the 'down' position, waiting for the mine car in the background to gravitate on to the front stops prior to being rammed into the cage.

Illustrations by courtesy of the National Coal Board.

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